DOCUMENT RESUME

ED 276 993 CS 208 885

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TITLE The Effect of Writing upon Good and Poor Writers' Learning from Prose.
PUB DATE [85]
NOTE 27p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Cognitive Development; Cognitive Processes; Grade 6; Intermediate Grades; *Language Processing; *Learning Activities; Memory; *Reading Comprehension; *Reading Writing Relationship; Transfer of Training; Writing (Composition); *Writing Exercises; *Writing Research; Writing Skills

ABSTRACT

To determine how writing, as compared to other learning activities, affects both good and poor writers' ability to remember factual information and transfer learning, a study (1) investigated the effectiveness of a writing activity requiring students to develop compositions by synthesizing information read, and (2) explored the correspondences between selected characteristics of writing performance and measures of learning. Subjects, 120 sixth grade students identified as average readers and either good or poor writers, were randomly assigned to one of four treatment conditions: writing activity, multiple-choice question activity, directed rereading activity, or unrelated activity (control condition). Subjects were asked to read an informative passage pertaining to the topic to be learned and to perform a specific follow-up activity. At the end of the learning period, students were given a test designed to measure transfer of learning and a test designed to measure memory of factual information. Results indicated that the writing activity enhanced both types of learning measured and was beneficial for both good and poor writers. Findings also indicated that characteristics of students' writing performance played an important role in both types of learning. However, analyses revealed that the correspondences between these characteristics and learning performances varied in strength, apparently affected by the interdependence of the nature of the writing tasks, the characteristics under consideration, and the type of learning tested. (Author/JD)

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THE EFFECT OF WRITING UPON GOOD AND POOR WRITERS' LEARNING FROM PROSE

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THE EFFECT OF WRITING UPON GOOD
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Abstract

This study investigated the effectiveness of a writing activity which required students to develop compositions, synthesizing information read. The study sought to determine whether the writing, as compared to other learning activities, would promote good and poor writers' memory of factual information and their ability to transfer learning. Additionally, the study explored correspondences between selected characteristics of writing performance and subsequent performances on measures of learning.

Data were collected in classrooms of 120 sixth-grade students identified as average readers and either good or poor writers. The subjects were randomly assigned to one of four treatment conditions: 1) writing activity, 2) multiple-choice question activity, 3) directed rereading activity, or 4) unrelated activity (control condition). On each day of the learning period, students read an informative passage pertaining to the topic to be learned and then performed a follow-up activity according to treatment condition. At the end of the learning period, students were given a test designed to measure transfer of learning and a test designed to measure memory of factual information. Additional data were obtained from the compositions of students who linked writing with their reading and learning. The compositions were analyzed to examine the extent to which pertinent characteristics of writing performance played a role in the students' learning.

The results revealed that the writing activity enhanced both types of learning measured and was beneficial for good and poor writers. The results also indicated that characteristics of students' writing performance played a role in both types of learning. However, correspondences between the characteristics and learning performances varied in strength, appearing to be affected by the interdependence of the nature of the writing tasks, the characteristic(s) under consideration, and the type of learning tested.

THE EFFECT OF WRITING UPON GOOD AND POOR WRITERS' LEARNING FROM PROSE

Language is not only valuable as a means of communication, but also is a valuable means of generating knowledge (Britton, 1970; Bruner, 1975; Vygotsky, 1962; Wells, 1981). Transforming ideas into words can organize and develop thoughts about experience. This is particularly evident in writing, where language must be represented fully.

In classrooms, much of what students are expected to learn is presented through texts that students read. When encountering unfamiliar information, students can profit from activities that assist them in their reading. It is reasonable to assume that writing could be valuable in helping students learn new information. It could be expected that through writing about things they have read, students will be better able to shape and incorporate the new information into their thinking. This study investigated whether writing could help students learn from informative prose. More specifically, the study was undertaken to examine whether a writing activity, as compared to other learning activities, would promote the learning of good and poor writers. Furthermore, the study explored whether specific aspects of writing performance appear to play a role in writing to learn from prose.

Background of the Study

Numerous educators contend that writing is a valuable tool for thinking and learning. As such, writing deserves a special place, not only in language arts classes, but also in other areas of the curriculum. Martin et al. (1976) encourage teachers of all subjects to incorporate writing as an integral part of learning, as opposed to using writing solely for evaluation. Similarly, Odell (1980) calls for allowing writing to be a daily part of learning within classrooms, rather than reserving writing only for long papers to be completed outside of class. Haley-James (1982) offers teachers rationale for using writing across the curriculum and describes a writing-to-learn environment.

Emig (1977), who describes correspondences between successful learning strategies and certain attributes of writing, asserts that writing is a unique mode of learning. Irmscher (1979) adds that writing is a way to increase our potential for future learning. Along with these arguments, a number of educators (e.g., Healy, 1981; Herrington, 1981; Scheffler, 1980) have recommended specific writing programs and activities--all of which suggest that writing enhances subject-matter learning.

These recommendations for using writing as a tool for learning are warranted in view of the related theoretical literature. Bruner (1975) contends that language is a powerful means for representing experience. Similarly, Britton (1970) states that writing enables learners to shape experience and that this symbolic representation of experience helps learners retain it for future use. The inherent relationships within language and its rules for combining experience introduce organization to experience.

Vygotsky (1962) offers a compelling explanation of why the writing process aids thought processes. According to Vygotsky, there is not a one-to-one correspondence between the structure of thought and the structure of written language. Unlike written language, thought does not consist of a series of units which can be understood by others. Even in inner speech, a plane of verbal thought that serves mental orientation, meaning predominates and speech is abbreviated. Once a thought occurs, the construction of a written message must proceed from this abbreviated inner speech. The transformation of thought through inner speech to written language is a complex, sometimes difficult process. However, this transformation aids thinking. As Vygotsky explains: "The change from maximally compact inner speech to maximally detailed written speech requires what might be called deliberate semantics--deliberate structuring of the web of meaning" (p. 100).

Luria (1981) adds that because writing calls for this deliberate analysis of meaning though categories of language, writing plays an important role in thought processes. Frank Smith (1982) also notes that writing permits one to organize thoughts, and that the writer's thoughts and the words written influence each other.

These theoretical discussions point out that writing is not just a matter of unveiling one's thoughts; it also entails the shaping and organizing of those thoughts. Given the theoretical support for using writing to enhance learning, it follows that writing would be beneficial in promoting learning from reading materials. In discussing the nature of the reading process, cognitive psychologists (e.g., Anderson, 1977; Bransford and McCarrell, 1974; Rumelhart, 1981) tell us that readers create an interpretation of the text through relating incoming cues to their existing knowledge. Craik and Lockhart (1972) note that if readers process information thoroughly they can enhance their memory of it. When readers analyze a passage thoroughly, they relate the text to prior knowledge and encode the information semantically. The more thoroughly information is analyzed, the more elaborated and enduring will be the memory trace. Similarly, Bruner (1961) and Frank Smith (1971) point out that information is more likely to be available for future use if it has been organized to reduce its complexity by integrating it into cognitive structure. However, as Bretzing and Kulhavy (1979) state, students may not thoroughly process information through their independent reading and therefore can benefit from activities designed to help them learn that information. As theorists concerned with the nature of the writing process tell us, writing is a valuable tool for promoting thinking and learning.

Previous research studies generally support using writing to promote understanding and learning. Summarizing (Newlun, 1930); outlining (Barton, 1930); one-sentence summarizing (Doctorow, Wittrock, and Marks, 1978; Taylor and Berkowitz, 1980); summarizing and paraphrasing in note-taking (Bretzing and Kulhavy, 1979); and hierarchical summarizing (Taylor and Beach, 1984) have all been found to be beneficial. However, research thus far has failed to address several questions. In comparing writing to other learning activities, previous studies have not provided support for using writing to promote transfer of subject-matter learning. Yet Bruner (1957) contends that transfer of learning should be the prime goal of instruction. Furthermore, research has not considered whether a student's level of writing skill has a bearing on ability to benefit from a writing activity. Perhaps writing, a powerful means for structuring

experience, helps both good and poor writers. However, it could be argued that poor writers cannot fully profit from writing activities; therefore, they are better served by activities that do not require writing. Finally, previous studies have not uncovered the extent to which specific aspects of writing performance are important in promoting learning.

In light of issues not addressed in research to date, the purposes of this present study were formulated. This study investigated the effectiveness of a writing activity which required students to form a composition, selecting and combining ideas read. The effectiveness of the writing activity was compared to that of other learning activities: answering multiple-choice questions, directed rereading, and an unrelated activity (control condition). Moreover, the study sought to determine whether the writing and other learning activities would differentially affect the learning of good and poor writers. To measure the students' learning and thereby measure the effectiveness of the writing and other learning activities, students' performances were examined on two tests: a test which required students to transfer learning and a test which measured memory of factual information. Finally, the compositions of students who wrote during learning were analyzed in order to investigate correspondences between specific aspects of writing performances and performances on measures of learning.

Method

Subjects

The subjects were sixth-grade students attending two rural-suburban middle schools in Central Texas. Although the study was conducted in twelve classes in which all of the students participated, the students who were selected as subjects were those considered to be 1) average in reading comprehension ability and 2) either good or poor writers. Reading comprehension ability was determined upon the basis of teacher judgment and performance on the reading comprehension subtest of the Comprehensive Test of Basic Skills (1982). From the pool of average readers, good and poor writers were identified on the basis of two writing samples collected on different occasions. After the average

readers were stratified on writing ability (good or poor), they were randomly assigned to one of four treatment conditions. Fifteen good and fifteen poor writers were assigned to each of the four treatment conditions, yielding a total of 120 subjects.

Materials

A number of materials were developed to study the effectiveness of writing upon good and poor writers' learning from prose. Two writing tasks were designed for collecting the writing samples used to assess the students' writing ability prior to the learning period of the study. These two writing tasks were designed to closely parallel the type of writing required during the learning period of the study. Thus, each required students to write for the purpose of informing/explaining to a friend as audience. Attention was also given to the topic of the two writing tasks, with the goal that each be appropriate to sixth-grade students' background of experiences. One of the tasks required students to inform or explain to a friend the content of a favorite television program, one that the friend had never seen. The other task required students to inform or explain to a friend from outer space what a school is.

During the learning period students were presented three unfamiliar, informative passages to read. The topic of the passages was a game played by children in British countries. Each passage was approximately 500 words in length, with passages one, two, and three containing 481, 504, and 491 words respectively. The readability was checked by asking two sixth-grade reading teachers to evaluate the passages and by applying two readability formulas. The passages were found to be in the sixth-grade range of readability by the Fry (1968) readability graph, and at the fifth/sixth grade levels using the Dale-Chall (1984) readability formula.

For each of the three passages, follow-up activities were developed for the students to complete immediately after reading a passage. Four different types of activities were designed to correspond with each of the treatment conditions: 1) a writing activity, 2) multiple-choice questions, 3) directed rereading, and 4) an unrelated activity (control condition). The writing, multiple-choice question, and directed

rereading activities were designed to compare the effectiveness of activities which focused students' attention of important information in the text and which required them to attend to information beyond only reading. Therefore, these follow-up activities were designed to closely parallel one another in the content they focused upon in the text, although they differed in the manner in which they focused students' attention.

The writing activity for each passage required the students to synthesize information found in the passage. That is, each activity required students to focus upon various, selected aspects of the game and to combine those ideas in developing a composition. As stated previously, the purpose of each activity was to inform/explain, and the audience was a friend. The multiple-choice question activity consisted of eight questions, with four possible choices for each question. The questions were based upon the same information featured in the writing activity. The directed rereading activity for each passage asked the students to read the passage again and focus upon certain information. The directions were basically the same as those given to students in the writing activity group, except that students were to reread the passage for the purpose of synthesizing major concepts rather than write. A vocabulary activity that was unrelated to the topic of the informative passages was designed for students in the control group to complete after reading a passage.

Two types of multiple-choice tests were developed to measure the students' learning of information in the passages, thereby assessing the effectiveness of each of the treatment conditions. The first test, designed to measure transfer of learning, consisted of ten questions which required students to apply to novel situations concepts presented in the passages. Each question described an event that could occur during the game that was the topic of the passages and asked students to predict what would happen next. The second test consisted of ten questions that measured students' memory of factual information.

Data Collection Procedures

Prior to the learning activities of the study, writing samples were collected from the students on two different occasions to provide a basis for determining which students were either good or poor writers. The writing samples produced by average readers were holistically scored by two trained judges who used a 1 through 5 rating scale accompanied by a scoring guide. The scoring guide focused upon the quality of ideas presented and the extent to which a students' paper addressed the demands of the task. Students whose two writing samples received a 1 or 2 from both judges were considered to be poor writers. Students whose two writing samples received either a 4 or 5 from both judges were considered to be good writers. The interrater proportion of agreement, based upon the individual ratings of the two raters, was .91 for the writing task about school and .89 for the writing task about a favorite television program. After the students who were average in reading comprehension ability were stratified on writing ability, they were randomly assigned to one of four treatment conditions.

The learning period occurred as a series of activities in twelve regular reading classes. For each class, the learning period lasted over a period of four days. On each of the first three days, students first read one of the instructional passages pertaining to the topic to be learned. When all of the students finished reading the passage, they were given handouts and materials which instructed them to perform tasks according to their assigned treatment condition: 1) a writing activity which required them to synthesize major concepts in the passage, 2) a multiple-choice question activity which reviewed major concepts, 3) a directed rereading activity which required students to synthesize major concepts but not write, and 4) a control group activity which required students to solve vocabulary puzzles unrelated to the topic of the passages. Students were allowed to keep the passage and were told they could refer to the passage in completing their activities. Following the three days devoted to reading and follow-up activities, students were tested on the fourth day. The students first completed test one which measured transfer of learning. When all of the students had finished, test one was collected and

students were given copies of test two which measured their memory of factual information.

Data Analysis Procedures

To investigate the effect of writing upon students' learning from prose, students' tests were scored, and data obtained were analyzed to examine the effectiveness of the writing and other learning activities. Additionally, the compositions written by students were analyzed to explore correspondences between selected characteristics of writing performance and subsequent performance on measures of learning.

Test Performances. For each test, a subject's total number of correct responses was determined. A 2 (writing ability) by 4 (treatment condition) analysis of variance was used to analyze the data for each test. These analyses were used to examine the effectiveness of the four treatment conditions across good and poor writers. Of particular concern was whether students in the writing activity group would perform significantly better than students in the other treatment conditions. Also of particular concern was whether students in the control group would perform significantly lower than students in the three treatment conditions which required them to attend to the text more thoroughly, or whether these treatment conditions were superfluous. The results of the analyses of variance were also used to determine whether there was a significant interaction between writing ability and treatment condition, whether the writing and other learning activities would differentially affect the learning of good and poor writers. Of particular concern was the performance of poor writers who might be expected to profit more from activities that did not require writing.

Analysis of the Written Compositions. To describe more fully the role of writing in good and poor writers' learning from prose, the researcher analyzed the compositions produced by students assigned to the writing activity group. These analyses were undertaken to determine the extent to which performance on each measure of learning could be predicted on the basis of the following: 1) amount of correct information in the compositions, 2) amount of test-related information in the compositions,

3) appropriateness of the responses in the compositions to the directions given, 4) the clarity of the compositions, and 5) the organization of the compositions.

To obtain a measure of the quantity of correct information in the students' writing, the semantic content of the students' writing was compared to the semantic content of the passages. This was done by establishing a list of idea units found in each passage and comparing the established lists to the idea units found in the students' compositions. The number of idea units in the passages was determined by two scorers who worked individually and in conference. The interscorer proportion of agreement was .96, .91, and .93 for passages one, two, and three respectively. All disagreements were resolved by consensus. Using the same procedure, the scorers also determined the number of idea units within each student's composition. These idea units were then compared to the lists established for the passages. Each of the thirty students in the writing activity group received a score based upon the total amount of correct information in their three compositions.

The compositions of the students in the writing activity group were further analyzed to determine the amount of information they contained that was directly related to the subsequent questions presented in the two tests to measure learning. To do this, the test's questions and answers and answers were compared to sources of information within the passages. For each test, a list of test-related idea units was established; these lists represented the idea units within the passages that were drawn upon for question-answer relationships. Each of the two lists of test-related idea units was then compared to the idea units found in the students' compositions. From these comparisons, two scores were derived for each student. These scores represented the number of idea units within the students' compositions that were directly related to each of the two tests.

The compositions of students in the writing activity group received an overall rating on three qualities: 1) appropriate response to the directions given, 2) clarity, and 3) organization. Working individually, and then in conference, the two judges assigned

scores, using a 1 through 5 rating scale. Each of the three compositions of a student received a rating. To obtain an overall rating on each of the qualities, the scores from each composition were added together. The proportion of agreement between the raters, based upon their individual ratings, was .88 for appropriateness of the response, .89 for clarity, and .91 for organization. Any differences were resolved through consensus.

These selected characteristics of the students' writing served as the predictor variables for a regression analysis performed separately on the test which measured transfer of learning and on the test which measured memory of factual information. That is, students' scores on a test were entered as the criterion measure; also entered were scores for each of the following characteristics or predictor variables: 1) amount of correct information, 2) amount of test-related information, 3) appropriateness of responses to directions given, 4) clarity of responses, and 5) organization of the responses. These regression analyses were undertaken to determine the proportion of variance in performance on each test that could be accounted for by all five characteristics together and by each characteristic independently. Further analysis yielded information about the amount of variance that variables shared in predicting performance on each test. All of these analyses were performed using the PRIME computer program COMMAP (Veldman, 1978).

The independent, or unique, contribution of a characteristic (predictor) was determined by comparing full to reduced regression runs. This regression technique permits the researcher to determine the influence of a single predictor even though the predictors were correlated with each other. In this procedure, all five predictors were entered in the full model. Then, each factor--in turn--was omitted from the regression equation. The drop in variance accounted for in a following run (all predictors minus one) revealed the proportion of variance unique to the omitted predictor--the contribution of the predictor over and beyond its contribution that was shared with other predictors. After each run, the deleted factor was reinserted and another factor was removed for the next run. The extent of shared, or joint, contributions was determined

through commonality analyses, which accompanied each full to reduced regression run (Veldman, 1978).

Results

Effectiveness of the Learning Activities

Two types of tests were used to measure the effectiveness of the writing and other learning activities. The first test measured the students' ability to generalize or to transfer learning; the second test measured the students' ability to remember factual information read. The students' scores on these dependent measures yielded data for two-way analyses of variance. These analyses were used to examine the effectiveness of the writing and other learning activities across good and poor writers and to detect whether the relative effectiveness of the learning activities was similar for good and poor writers.

Test One: Transfer Measure. The means and standard deviations of students' performance on test one are presented in Table 1. The results of the 2 (writing ability) by 4 (treatment condition) analysis of variance revealed that there was a significant main effect for treatment condition [F (3, 112) = 22.31, $p < .001$]. There were not a significant interaction between writing ability and treatment condition. Further analysis using Neuman-Keuls post hoc tests showed that students assigned to the writing activity group scored significantly higher ($p < .01$) than students assigned to either the multiple-choice question, directed rereading, or control groups. Students assigned to the multiple-choice question or directed rereading groups scored significantly higher ($p < .01$) than students in the control condition. The test performances of students assigned to the multiple-choice question or directed rereading groups were not significantly different.

Test Two: Memory of Factual Information. The means and standard deviations of the student's performance on test two are presented in Table 2. The results of the 2 (writing ability) by 4 (treatment condition) analysis of variance revealed a significant main effect for treatment condition (F (3,112) = 11.85, $p < .001$). The results also

Table 1. Summary of Means and Standard Deviations of Correct Responses on Test One: Transfer Measure.

Treatment Condition	Writing Ability Group: Good n[a]	Good M	Good SD	Poor n[a]	Poor M	Poor SD	Total n	Total M	Total SD
Writing		9.3	.6		8.4	1.4	(30)	8.9	1.2
M-C Questions		6.7	2.0		6.2	2.2	(30)	6.5	2.1
D. Rereading		7.2	2.3		5.9	1.9	(30)	6.6	2.2
Control		5.2	2.3		4.5	2.0	(30)	4.9	2.2
Total	(60)	7.1	2.4	(60)	6.3	2.3			

Note. Maximum score for each test = 10.

[a]n = 15 for each treatment condition.

Table 2. Summary of Means and Standard Deviations of Correct Responses on Test Two: Memory of Factual Information.

Treatment Condition	Writing Ability Group: Good n[a]	Good M	Good SD	Poor n[a]	Poor M	Poor SD	Total n	Total M	Total SD
Writing		9.0	.9		8.3	1.2	(30)	8.7	1.1
M-C Questions		7.1	2.2		6.0	1.9	(30)	6.6	2.1
D. Rereading		7.2	1.7		5.9	2.3	(30)	6.6	2.1
Control		5.8	2.6		5.9	2.2	(30)	5.9	2.4
Total	(60)	7.3	2.2	(60)	6.5	2.1			

Note. Maximum score for each test = 10.

[a]n = 15 for each treatment condition.

revealed that there was not a significant interaction between writing ability and treatment condition. The results of the Neuman-Keuls post hoc tests showed that students in the writing activity group again scored significantly higher ($p < .01$) than students in all other treatment conditions. Students assigned to the multiple-choice question and directed rereading groups did not differ significantly in their performances, nor did they score significantly higher than students in the control condition.

Writing Performance and Learning

The three compositions of each student who wrote after reading received scores on five characteristics of writing performance. These five characteristics served as the predictor variables for the regression analysis performed on each of the two measures of learning. These analyses revealed the extent to which variance in test performance could be accounted for by the selected characteristics of writing performance.

Test One: Transfer Measure. The results of the full and reduced comparison regression analysis on the first test are shown in Table 3. All five of the characteristics of writing performance accounted for 76.15% ($p < .001$) of the variance in scores on test one. In regard to the independent (unique) contributions of the characteristics, test-related idea units and appropriateness of response made statistically significant contributions to an explanation of performance of test one. Test-related idea units accounted for 6.85% ($p < .02$) of the variance in scores on test one when its unique contribution was determined; appropriateness of response to directions given accounted for 5.43% ($p < .03$) of the variance in performance on test one. Correct idea units, clarity, and organization did not make significant unique contributions.

The influence of each characteristic was increased when the results of the commonality analyses were considered because these analyses revealed the joint, or shared, contributions of the characteristics. For example, the influence of each characteristic was increased by 31% due to the amount of variance all five characteristics shared, or had in common, in predicting performance on test one. Another notable source of shared contribution was that of appropriateness of response, clarity, and organization, each of which increased an additional 13% when the contribution they shared was taken into account. Because of large shared contributions such as these--which are representative of the high correlations among the variables in predicting performance on the transfer test--the potential for large unique contributions was reduced. Nevertheless, although the results of the commonality analyses suggested that all of the characteristics played more than a minor role when joint

Table 3. Summary of Results of Regression Analysis on Test One: Transfer Test.

		R^2	df	p	n
Full Model -	Correct Idea Units, Test-Related Idea Units, Appropriateness of Response, Clarity, Organization	.7615	5,24	.0000	30
Unique -	Correct Idea Units	.0182	1,29	N.S.	30
Unique -	Test-Related Idea Units	.0685	1,29	.0142	30
Unique -	Appropriateness of Response	.0543	1,29	.0266	30
Unique -	Clarity	.0059	1,29	N.S.	30
Unique -	Organization	.0185	1,29	N.S.	30

contributions were considered, it is important to keep in mind that the characteristics were redundant to a considerable extent in their predicting performance on the transfer test. Test-related idea units and appropriateness of response were the only characteristics that made significant unique contributions.

Test Two: Memory of Factual Information. The results of the full and reduced comparison regression analysis on test two are shown in Table 4. The results indicated that all five of the characteristics of writing performance accounted for 49.51% ($p < .005$) of the variance in scores on test two. The only characteristic that made a significant unique contribution was test-related idea units, which accounted for 11.75% ($p < .03$) of the variance in test scores.

As in the results for test one, the results of the commonality analyses revealed that the variables shared a great deal of variance predictive of test two performance. The influence of each characteristic was considerably larger when its unique and joint contributions were considered. Yet test-related idea units made a significant independent contribution.

Table 4. Summary of Results of Regression Analysis on Test Two: Memory of Factual Information.

	R^2	df	p	n
Full Model - Correct Idea Units, Test-Related Idea Units, Appropriateness of Response, Clarity, Organization	.4951	5,24	.0042	30
Unique - Correct Idea Units	.0220	1,29	N.S.	30
Unique - Test-Related Idea Units	.1175	1,29	.0251	30
Unique - Appropriateness of Response	.0001	1,29	N.S.	30
Unique - Clarity	.0002	1,29	N.S.	30
Unique - Organization	.0297	1,29	N.S.	30

Discussion

The results of the analyses of variance indicated that writing was a valuable means for promoting students' learning from informative prose. Moreover, writing was beneficial for both good and poor writers. The results of the regression analyses indicated that the selected characteristics of students' writing performance did play an important role in students' learning. However, the correspondences between characteristics of students' writing and their subsequent success on measures of learning were not uniformly strong.

Effectiveness of the Learning Activities

When students were tested at the end of the learning period, those who had engaged in a writing activity after reading outperformed students who had answered multiple-choice questions, engaged in directed rereading, or completed an unrelated activity (control condition). Both good and poor writers who had written compositions as part of their learning performed substantially better on the test which measured transfer of learning and on the test which measured memory of factual information. The relative effectiveness of the other learning activities was also the same for good and poor writers. In performing the transfer test, both good and poor writers appeared

to have gained some insight from engaging in the multiple-choice question and directed rereading activities. Although students who had engaged in these activities performed substantially lower than students who had developed compositions, they outperformed students in the control group who had only read the passages. The findings also revealed that the multiple-choice question and directed rereading activities were equal in their effectiveness in that students in these groups did not differ in their performances on the transfer test.

When asked to remember factual information about the topic, students in the writing activity group again performed substantially better than those in the multiple-choice question, directed rereading, and control groups. As on the transfer test, both good and poor writers who wrote outperformed students in the other treatment conditions, and the relative effectiveness of the learning activities was the same for good and poor writers. However, on this test which measured memory of factual information, good and poor writers in the multiple-choice question and directed rereading groups did not perform substantially better than those in the control group. The students who only read the passages learned almost as much factual information through their independent reading as did the students who supplemented their reading by answering multiple-choice questions or performing the directed rereading. In promoting memory of factual information, writing was the only activity that substantially supplemented students' reading.

These findings indicate that writing was not only the most effective means for helping students learn from their reading, but also was the only means that consistently helped students gain insight beyond that attained through reading. The superiority of the writing activities can be partially understood by comparing attributes of the writing tasks to those of answering multiple-choice questions or engaging in directed rereading. The writing, multiple-choice questions, and directed rereading were parallel in that they helped students review the same information as was contained in the passages. However,

the inherent demands of the writing activities differed from those of the other activities designed to supplement students' reading.

Both the multiple-choice questions and writing activities focused students' attention upon important ideas. However, in completing the writing activities, students were required to form relationships among ideas through the development of a unified response for someone other than self. While the directed rereading activities required students to focus upon ideas and to form relationships among them, the students were required only to reread and think about certain information. The writing activities contained the same assignments as those of the directed rereading activities except that in completing a writing activity, students were to develop a composition in synthesizing information read. Therefore, students were not only required to think about important ideas and to form relationships, but also required to state explicitly their connections.

While results of the data analyses showed that both good and poor writers were able to profit from writing, the results also showed that some students were able to profit more than did others. While the students who wrote had less variance in their test scores than did students in the other groups, there was some variance in the test scores of students who wrote. The analysis of students' compositions, or examination of characteristics of writing performance, attempted to uncover possible sources of variance in test performances of students who wrote as part of their learning.

Writing Performance and Learning

The findings indicate that specific characteristics of students' written compositions played a role in successful learning. Correct idea units, test-related idea units, appropriateness of response to directions given, clarity, and organization together accounted for approximately 76% of the variance in scores on the transfer test. These characteristics accounted for approximately 50% of the variance in scores on the test which measured memory of factual information. The discrepancy between tests in the amount of variance accounted for by the characteristics indicates that the manner in which students wrote played a more important role in predicting performance on the

transfer test than it did in predicting performance on the test which measured memory of factual information. Students' writing performance may have played a smaller role on the test which required remembering factual information because students gleaned factual information through their independent reading. While this is only a speculation because the characteristics of writing performance were the only predictors in the regression analyses, other findings support this possibility. The results of the analyses of variance showed that all of the activities designed to assist the students in their reading made a smaller impact on students' memory of factual information as compared to their ability to form generalizations, or to perform the transfer test. Students could gain almost as much knowledge of isolated facts through reading as they did from performing the multiple-choice question or directed rereading activities. Although the students who wrote consistently performed substantially better than students who only read the passages, the differences between these groups' performances was greater on the transfer test.

The role of writing performance can be further understood by noting the demands of the writing tasks. In responding to the writing tasks, students were required not only to focus upon individual ideas, but also to arrange them, developing relationships among the individual units. The integrative thinking required and developed through the writing tasks was also necessary for the forming of generalizations, which was the focus of the transfer test. On the other hand, the test which measured recall of factual information focused upon isolated pieces of information. The writing activities also promoted performance on this test in that they helped students more thoroughly review the content read. Yet the benefits derived from the writing were not fully exploited through this type of testing. Therefore, while writing performance was a good predictor of success on both tests, it played a more important role in predicting the students' ability to demonstrate their having formed generalizations--a type of thinking encouraged by the type of writing students performed and one not easily attained solely through independent reading.

The data also indicate that individual characteristics varied in the extent to which they predicted test performance. While generally each of the characteristics played more than a minor role if one takes into account the amount of variance a characteristic shared with others, two characteristics were found to contribute beyond what was contributed by others in predicting test performance. Test-related idea units made a strong independent contribution to predicting performance on both tests. Appropriateness of response made a strong independent contribution to the predicting of performance on the transfer test alone. Thus, the students' inclusion of information related to a test was consistently a strong indicator of success on the tests. Whether students attempted to fulfill the demands of the writing tasks was a strong indicator of success only on the transfer test. An apparent reason for this finding is revealed by examining the nature of the writing assignments. The writing assignments were developed in consideration of the ultimate objective of reading to learn about an unfamiliar game, the objective being that students would learn how to play the game. (The writing assignments then became the basis for developing content of parallel multiple-choice question and directed rereading activities.) The directions for the writing tasks required students to explain to a friend aspects of how to play the game that was the topic of the passages. Students' scores on appropriateness of response reflected the extent to which they fulfilled those directions. In performing the transfer test, students were required to predict outcomes of situations that could occur if they were actually playing the game which was the subject of the passages. Success on this measure indicated that students had understood relationships among ideas well enough to have formed generalizations that would help them encounter novel situations. Thus, it could be expected that students' attempts to fulfill the demands of the writing assignments would correspond to their performance on the transfer test. In view of the nature of the writing assignments, it also becomes clear why appropriateness of response was not a strong indicator of success on the test which measured memory of factual information. Performance on that test did not rest upon integration of information, but rather it called for

remembering isolated facts. While students' attempts to fulfill the directions of the tasks most likely included reviewing the facts tested, students could have included those facts in their writing (i.e., test-related idea units) without doing a good job in fulfilling the directions of the assignments. Students possibly could have included the facts necessary to perform well on the test without thoroughly forming the types of relationships among ideas specified in the writing assignments. Although appropriateness of response to the writing tasks in this study was not a strong indicator of success on the test which measured memory of facts, it perhaps could be if the writing tasks were ones that dealt exclusively with focusing upon isolated units of information, thereby changing what constituted an attempt to follow the directions of the writing assignments.

In examining the strong independent contributions of test-related idea units and appropriateness of response, one should note that these two characteristics are not closely associated with overall writing ability per se. Rather, these characteristics pertain more to the type of information students focus upon and the extent to which they try to meet the demands of a writing task, regardless of how well students write. Because of the important role played by these characteristics, it becomes clearer why the poor writers were also able to profit from writing.

Implications for Research and Teaching

The findings of this study are encouraging for those who recognize the value of linking reading and writing to promote learning, yet question whether it would best serve the interests of the poor writer. Good as well as poor writers were able to profit more from the writing activity than from the activities that did not require writing. Also significant is the finding that writing promoted students' ability to remember factual information and their ability to form generalizations. Because writing encouraged both of these kinds of thinking, it appears to be a valuable tool for not only enhancing mastery of specifics in an immediate learning situation, but also for helping students encounter future learning and applications. Thus, these findings lend additional support to theoretical literature (e.g., Britton, 1970; Bruner, 1975; Vygotsky, 1962; Wells, 1981)

which contends that writing is a powerful means for shaping and representing experience. These findings similarly suggest that writing should be used across the curriculum. Both good and poor writers were able to profit from writing- -a finding which suggests that writing should neither be reserved only for language arts classes, nor should it be reserved only for the more competent writers.

However, these findings also suggest that attention needs to be directed towards the way in which writing is integrated with reading and learning. To ask students to write without regard to learning objectives may deny them the opportunity to realize the benefits of writing in their learning. The results pertaining to the role of characteristics of writing performance suggest that the nature of the writing task, writing performance, and subsequent learning are closely related. The results indicate that in using writing to help students learn, one should structure writing activities so that they help students incorporate in their writing those particular ideas they are expected to learn. If students write about a topic but are not asked to do so in a way that helps them to focus upon the targeted information, writing may not help students achieve the learning goals set forth.

The results also indicate that the manner in which writing is used could matter in other important ways. All of the characteristics on writing performance, particularly appropriateness of response to directions given, played considerably larger roles in helping students form generalizations as opposed to remembering isolated facts. It was noted that the writing assignments themselves were designed to promote the type of understanding necessary for forming generalizations. Thus, the manner in which students wrote or how well they fulfilled the demands of the writing task was more critical for enhancing some types of thinking than others, the difference seemingly relying upon whether the writing tasks required the type of thinking under consideration. The significance of these findings is that the relationship between the type of writing performed, the way it is performed, and the type of learning that results is more specific than suggested in other classroom studies. In examining the effects of literacy upon a society, Scribner and Cole (1981) found that particular types of writing promoted

particular types of thinking; it may be that the immediate consequences of writing are similar in some respects to the long-term consequences described by these researchers.

Suggestions for Future Research

Limitations in the scope of this study, along with the questions it raised, suggest several avenues for future research. This study involved only average readers. A future, similar study needs to be conducted using poor writers who are also poor readers. Additionally, future research needs to compare the effectiveness of discussion in writing-to-learn. Long-term retention associated with writing versus other means of learning also deserves attention.

The results of this study revealed that characteristics of students' writing performance played a more critical role in one type of learning than in another. Furthermore, the results suggested that the manner in which students wrote mattered the most when the writing task required thinking parallel to the measure of learning. Using various types of writing assignments and measures of learning, future research could define more clearly the interdependence of writing task, writing performance, and subsequent learning. Future studies could specify the types of learning that are promoted by specific writing tasks and the kinds of writing behaviors associated with success in each of these relationships.

Observational studies could provide an alternative means to examine the role of writing in students' learning. Much could be learned from classrooms where teachers have integrated writing with other areas of language, capitalizing upon students' interests and needs. Through observations in classrooms such as these, researchers could not only study sound ways to use writing as a means to help students learn, but also document and discover other immediate and accrued benefits of writing.

Many questions concerning the role of writing in reading and learning remain unanswered. For now, however, this study and others indicate that writing can be a valuable tool for helping students master information they read. Furthermore, teachers themselves should be encouraged to discover and to decide the most fruitful ways to

incorporate writing in their classrooms. The research to date can have most value when teachers provide students meaningful opportunities to write. For then students will be most apt to discover the value of writing, the potential it has to sharpen their focus and to crystallize their thoughts about experience.

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